

FRAME FORMAT IN COMMUNICATIONS

FIELD OF THE INVENTION

[0001] The exemplary and non-limiting embodiments of this invention relate generally to wireless communications networks, and more particularly to frame format selection.

BACKGROUND ART

[0002] The following description of background art may include insights, discoveries, understandings or disclosures, or associations together with disclosures not known to the relevant art prior to the present invention but provided by the invention. Some such contributions of the invention may be specifically pointed out below, whereas other such contributions of the invention will be apparent from their context.

[0003] Full duplex refers to a capability of simultaneous two-way and independent transmissions in both directions (i.e. transmission and reception). Typically, FDD (frequency division duplex) systems are capable of full duplex operation. Time division duplex (TDD) refers to a duplex in which several signals are interleaved in time for transmission over a common frequency channel. In TDD, the same frequency channel may be used for transmission in both directions. In practical realizations, TDD systems are realized by means of a half duplex principle wherein both ends of a bidirectional connection alternate between transmitting and receiving bursts of data. This means that tx/rx nodes are not able to perform transmission and reception simultaneously.

SUMMARY

[0004] The following presents a simplified summary of the invention in order to provide a basic understanding of some aspects of the invention. This summary is not an extensive overview of the invention. It is not intended to identify key/critical elements of the invention or to delineate the scope of the invention. Its sole purpose is to present some concepts of the invention in a simplified form as a prelude to the more detailed description that is presented later.

[0005] Various aspects of the invention comprise a method, an apparatus, a user equipment and a computer program product as defined in the independent claims. Further embodiments of the invention are disclosed in the dependent claims.

[0006] An aspect of the invention relates to a method for selecting a frame format in a communications system, the method comprising predefining, in a communications apparatus, a TDD data frame structure such that a TDD frame has a predefined frame duration defining a link direction 1-link direction 2 switching point periodicity, the frame duration defining a maximum time in which a half-duplex apparatus performs a cycle transmit-receive-transmit and/or a cycle receive-transmit-receive, wherein a link direction 1-link direction 2 ratio is adjustable on a symbol level in the TDD frame, wherein the TDD frame is partitioned into one or more of a guard period, a link direction 2 portion and a link direction 1 portion.

[0007] A further aspect of the invention relates to an apparatus comprising at least one processor, and at least one memory including a computer program code, wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus to predefine, a TDD data frame structure such that a TDD frame has a predefined frame duration defining a link direction 1-link direction 2 switching point periodicity, the frame duration defining a maximum time in which a half-duplex apparatus performs a cycle transmit-receive-transmit and/or a cycle receive-transmit-receive, wherein a link direction 1-link direction 2 ratio is adjustable on a symbol level in the

TDD frame, wherein the TDD frame is partitioned into one or more of a guard period, a link direction 2 portion and a link direction 1 portion.

[0008] A still further aspect of the invention relates to a user equipment comprising at least one processor, and at least one memory including a computer program code, wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the user equipment apply a TDD data frame structure such that a TDD frame has a predefined frame duration defining a link direction 1-link direction 2 switching point periodicity, the frame duration defining a maximum time in which a half-duplex apparatus performs a cycle transmit-receive-transmit and/or a cycle receive-transmit-receive, wherein a link direction 1-link direction 2 ratio is adjustable on a symbol level in the TDD frame, wherein the TDD frame is partitioned into one or more of a guard period, a link direction 2 portion and a link direction 1 portion.

[0009] A still further aspect of the invention relates to a computer program product comprising program code means adapted to perform any one of the method steps when the program is run on a computer.

[0010] Thus the frame structure disclosed enables a fast time division duplex (TDD) access and fully flexible UL/DL switching.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] FIG. 1 illustrates a frame structure type 2;

[0012] FIG. 2 illustrates a flexible UL/DL structure proposal in LTE Release-11;

[0013] FIG. 3 illustrates frame structures of normal and special frames according to an exemplary embodiment;

[0014] FIG. 4 illustrates dynamic UL/DL ratio adjustment according to an exemplary embodiment;

[0015] FIG. 5 illustrates a hierarchical frame structure according to an exemplary embodiment;

[0016] FIG. 6 shows a simplified block diagram illustrating exemplary system architecture;

[0017] FIG. 7 shows a simplified block diagram illustrating exemplary apparatuses;

[0018] FIG. 8 shows a messaging diagram illustrating an exemplary messaging event according to an embodiment of the invention;

[0019] FIG. 9 shows a schematic diagram of a flow chart according to an exemplary embodiment of the invention;

[0020] FIG. 10 shows a schematic diagram of a flow chart according to another exemplary embodiment of the invention;

[0021] FIG. 11 illustrates a flexible location of a protected part in a frame according to an exemplary embodiment;

[0022] FIG. 12 illustrates a location of a guard period in a frame according to an exemplary embodiment;

[0023] FIGS. 13 and 14 illustrate a location of two protected parts in a frame according to an exemplary embodiment.

DETAILED DESCRIPTION OF SOME EMBODIMENTS

[0024] An exemplary embodiment relates to a future beyond-4G (B4G) radio system. It may, however, also be introduced in an evolution of LTE within any new release. A specific use case is over-the-air discovery and direct data communication with LTE D2D. The focus is especially on time division duplex (TDD) in a local area optimized radio system.

[0025] In a B4G radio system, tight latency requirements of ~1 ms may set tight targets for round trip time (RRT), causing also faster UL/DL switching time requirements. The current